

Appl. No. 10/676,411
Amndt. Dated December 8, 2006
Reply to Office Action of September 13, 2006

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REMARKS/ARGUMENTS

Claims 1-24 are pending in the present application.

This Amendment is in response to the Office Action mailed September 13, 2006. In the Office Action, the Examiner rejected claims 1-3, 7-11, 15-19, and 23-24 under 35 U.S.C. §102(b); and claims 4, 5, 6, 12, 13, 14, 20, 21, and 22 under 35 U.S.C. §103(a). Applicants have added new claims 25-27. Applicants submit that the newly-added claims introduce no new matter. Reconsideration in light of the amendments and remarks made herein is respectfully requested.

New Claims 25-27

Applicants submit that the cited prior art references do not disclose, suggest, or render obvious the thickness of the imaging layer being balanced with dosage of radiation exposure to have an overall transmission of approximately 50%.

Rejection Under 35 U.S.C. § 102

In the Office Action, the Examiner rejected claims 1-3, 7-11, 15-19, and 23-24 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,565,304 issued to Honda ("Honda"). Applicants respectfully traverse the rejection and submit that the Examiner has not met the burden of establishing a prima facie case of anticipation.

Honda discloses a chemically amplified radiation-sensitive composition used in a process for fabricating a semiconductor device. A resin including poly(hydroxystyrene) is mixed with one or more photoacid generator, one or more dissolution inhibitor, one or more solvent, as well as optionally, speed enhancers, optionally, anti-striation agents, optionally, anti-halation agent, and optionally, plasticizers (Honda, col. 3, lines 62-64; col. 5, lines 22-32). The alkaline dissolution inhibitor is from about 5% to 30% by weight of the solids of said radiation-sensitive composition. The photoacid generating compound is preferably from about 5% to 30% by weight of the solids of said radiation sensitive composition (Honda, col. 6, lines 51-55).

Honda does not disclose, either expressly or inherently, (1) a baseline material added by a highly absorbing material selected from fluorine (F), tin (Sn), bismuth (Bi), cesium (Cs), antimony (Sb), a fluoropolymer, a metallocene polymer, an alkoxide chelate polymer, and a carboxylate chelate polymer, (2) thinning the resist to a pre-determined thickness used as an

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imaging layer; (3) improving efficiency of a photoactive acid generator (PAG) to capture secondary electrons produced by an ionizing radiation in the resist; and (4) forming an etch resistant layer below the imaging layer.

First, Honda merely discloses mixing the resin such as the poly(hydroxystyrene) with photacid generator, dissolution inhibitor, solvent, speed enhancers, anti-striation agents, anti-halation agent, and plasticizers (Honda, col. 5, lines 22-32). None of these components is a highly absorbing material selected from fluorine (F), tin (Sn), bismuth (Bi), cesium (Cs), antimony (Sb), a fluoropolymer, a metallocene polymer, an alkoxide chelate polymer, and a carboxylate chelate polymer.

Second, Honda merely discloses applying the resist mixture to a substrate by any conventional method used in the photoresist art, including dipping, spraying, whirling, and spin coating (Honda, col. 8, lines 10-13). None of these methods corresponds to thinning. Coating to a desired thickness is conditioned on the type of spinning equipment (Honda, col. 8, lines 15-17), and therefore is not thinning. In fact, no thinning is employed because the resulting thickness is about 1.0-2.0 μm (Honda, col. 8, lines 43-45), not less than 100 nm.

Third, Honda merely discloses mixing the resin with one or more photoacid generators (PAG) and the PAG form acid moieties under irradiation of UV light (Honda, col. 8, lines 43-45), not improving efficiency of the PAG to capture secondary electrons.

Fourth, Honda merely discloses forming a radiation-sensitive region on a device substrate (Honda, col. 3, lines 45-46) using dipping, spraying, whirling, and spin coating (Honda, col. 8, lines 10-13). Honda specifically teaches that these resist materials are coated onto a substrate (Honda, col. 8, lines 22-23), not forming an etch-resistant layer below the imaging layer.

To anticipate a claim, the reference must teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Vergegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ 2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the...claim." Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ 2d 1913, 1920 (Fed. Cir. 1989). Since the Examiner failed to show that Honda teaches or discloses any one of the above elements, the rejection under 35 U.S.C. §102 is improper.

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Therefore, Applicants believe that independent claims 1, 9, and 17 and their respective dependent claims are distinguishable over the cited prior art references. Accordingly, Applicants respectfully request the rejection under 35 U.S.C. §102(b) be withdrawn.

Rejection Under 35 U.S.C. § 103

In the Office Action, the Examiner rejected claims 4, 12, and 20 under 35 U.S.C. §103(a) as being unpatentable over Honda in view of U.S. Patent No. 6,753,129 issued to Livesay et al. ("Livesay"); claims 5, 13, and 21 under 35 U.S.C. §103(a) as being unpatentable over Honda in view of U.S. Patent No. 7,049,044 issued to Gonsalves et al. ("Gonsalves") and claims 6, 14, and 22 under 35 U.S.C. §103(a) as being unpatentable over Honda in view of U.S. Patent No. 5,034,304 issued to Feely ("Feely").

Applicants respectfully traverse the rejection and submit that the Examiner has not met the burden of establishing a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP §2143, p. 2100-129 (8th Ed., Rev. 2, May 2004). Applicants respectfully submit that there is no suggestion or motivation to combine their teachings, and thus no *prima facie* case of obviousness has been established.

As discussed above, Honda does not disclose or suggest the elements recited in the independent claims 1, 9, and 17. Accordingly, a combination of Honda with any other references in rejecting the dependent claims is inappropriate.

Furthermore, as discussed below, the cited prior art reference(s) used to combine with Honda does/do not provide the motivation to combine or the limitations cited in the rejected dependent claims.

1. Claims 4, 12, and 20:

Honda discloses a chemically amplified radiation-sensitive composition used in a process for fabricating a semiconductor device as discussed above.

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Livesay discloses a method and apparatus for modification of chemically amplified photoresist by electron beam exposure. A photosensitive composition includes a mixture of a water insoluble, acid decomposable polymer which is substantially transparent to ultraviolet or x-ray radiation (Livesay, col. 7, lines 60-67). Acid decomposable polymers include cyclic olefins, acrylics and methacrylates, polymethylacrylate and polymethylmethacrylate (PMMA) (Livesay, col. 8, lines 20-57).

Honda and Livesay, taken alone or in any combination, do not disclose, suggest, or render obvious adding a percentage in volume at least one of the fluoropolymer, the metallocene polymer, the alkoxide chelate polymer, and the carboxylate chelate polymer, the percentage ranging from 10% to 20%.

The Examiner contends that Livesay, in col. 5, lines 55-61, in col. 7, lines 60-67, and in col. 8, lines 20-57, discloses that adding fluoro polymers in resist compositions enables the formation of a uniform film on the substrate, and increases the surface hardness and dry etch resistance of the resist pattern (Office Action, page 3, paragraph number 4). Applicants respectfully disagree and submit that the cited excerpts do not provide the recited limitation. For ease of reference, the above cited excerpts are copied below.

"at least one water insoluble, acid decomposable polymer which is substantially transparent to ultraviolet or x-ray radiation, wherein said polymer is present in the photosensitive composition in an amount sufficient to form a uniform film of the composition components when it is coated on a substrate and dried." (Livesay, col. 5, lines 55-61)

"The first step of the process according to the invention is coating and drying a photosensitive composition onto a substrate. The photosensitive compositions useful for the invention are themselves well known in the art and are composed of a mixture of a water insoluble, acid decomposable polymer which is substantially transparent to ultraviolet or x-ray radiation at a wavelength of about 157 nm, 193 nm, 248 nm or those of x-rays; a photosensitive compound capable of generating an acid upon exposure to sufficient activating energy at a wavelength of about 157 nm, 193 nm, 248 nm or those wavelengths of x-rays, or electron beams. Microelectronic devices may be produced when the substrate is a semiconductor material." (Livesay, col. 7, lines 60-67; col. 8, lines 1-5)

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"Acid decomposable polymers suitable for a chemical amplification photoresists are well known in the art and nonexclusively include cyclic olefins, and acrylics and methacrylates such as polyalkylacrylates and polyalkylmethacrylates, norbornene containing polymers, and alicyclic polymers. The most widely employed route involves free radical copolymerization of maleic anhydride with a cyclic olefin monomer. The maleic anhydride serves as an oxygen-rich polar unit whose hydrophilic nature offsets the hydrophobic nature of the cyclic olefin monomer. Other polymers include polymethylacrylate and polymethylmethacrylate (PMMA) as well as copolymers thereof and polymers which have a backbone of polymethylmethacrylate having pendant groups which do not substantially reduce the transparency of the polymer at the wavelengths of interest. PMMA has a particularly high transmittance to the light of 193 nm wavelength and it is known for its clarity, surface hardness, UV transparency and chemical resistance. PMMA is readily commercially available from Aldrich Chemical Company of Milwaukee, Wis. Preferably the polymer has a molecular weight in the range of from about 1,000 to about 800,000. Alicyclic polymers include acrylate/alicyclic polymers such as hybrid polymers produced by the free radical copolymerization of norbornene, maleic anhydride and either acrylic acid or t-butyl acrylate. A terpolymer of acrylonitrile, tertiary-butyl methacrylate and methacrylic acid has also been shown to have high transparency at 193 nm and excellent dry etch resistance. Siloxanes, silsesquioxane and poly{5-(2-t-butoxycarbonyloxy-2-trifluoromethyl-3,3-trifluoropropyl)norbornene] and hexafluoro-2-propanol polymers are useful for 157 nm sensitive compositions. Poly(4-hydroxystyrene) and poly(4-tert-butyloxycarbonyloxystyrene) polymers are useful for 248 nm photoresist compositions." (Livesay, col. 8, lines 20-57)

As seen from the above excerpts, Livesay merely discloses a mixture of a water insoluble, acid decomposable polymer which is substantially transparent to ultraviolet or x-ray radiation, and PMMA. None of these corresponds to one of the fluoropolymer, the metallocence polymer, the alkoxide chelate polymer, and the carboxylate chelate polymer.

Furthermore, none of the cited materials is added to the baseline material at a volume percentage ranging from 10% to 20%.

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2. Claims 5, 13, and 21:

Honda is discussed above.

Gonsalves discloses nanocomposite negative resists for next generation lithographics. Methacrylate-based CA resists that incorporate inorganic clusters of polyhedral oligosilsesquioxane (POSS) into the side chains are provided (Gonsalves, col. 4, lines 26-29).

Honda and Gonsalves, taken alone or in any combination, do not disclose, suggest, or render obvious thinning the resist to a thickness below 100 nm. As discussed in the 35 U.S.C. §102(b) rejection, Honda does not disclose or suggest thinning. Furthermore, Honda specifically teaches that the thickness is about 1.0-2.0 μm (Honda, col. 8, lines 43-45), which is 10 to 20 times more than the thickness of 100nm. Accordingly, Honda teaches away from the claimed invention because the thickness is different by an order of magnitude. Therefore, a combination of Honda with Gonsalves is improper. Furthermore, Gonsalves merely discloses a methacrylate-based CA resists that incorporate inorganic clusters (Gonsalves, col. 4, lines 26-29), not a resist having a baseline material added by a highly absorbing material selected from fluorine (F), tin (Sn), bismuth (Bi), cesium (Cs), antimony (Sb), a fluoropolymer, a metallocene polymer, an alkoxide chelate polymer, and a carboxylate chelate polymer.

3. Claims 6, 14, and 22:

Honda is discussed above.

Feely discloses a photosensitive compounds and thermally stable and aqueous developable negative images. A number of halogenated organic materials are suitable for use as photoacid generators to produce aqueously developable images on deep UV exposure (Feely, col. 5, lines 30-35). Submicron images on the order of about 0.2 to 1 micron are capable of being produced with the photosensitive composition using an X-ray source (Feely, col. 6, lines 51-53).

Honda and Feely, taken alone or in any combination, do not disclose, suggest, or render obvious increasing a PAG concentration in the resist. Feely merely discloses that when the photoacid generators are employed with the X-ray imaging, the minimum concentration was found to be much higher than when the same photoacid generator is used as a deep UV photoacid generator (Feely, col. 6, lines 21-28). The photoacid generators are used in combination of the acid hardening resins without any improved efficiency. Furthermore, Feely

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dies not disclose capturing secondary electrons. Fccly merely made an observation that the minimum concentration of the PAG is higher when used with X-ray than with deep UV, not to increase the PAG concentration to improve efficiency.

In summary, there is no motivation to combine Honda, Livesay, Gonsalves and Feeley because neither of them addresses the problem of absorptive resists with highly absorbing material. There is no teaching or suggestion that adding a highly absorbing material is present. Honda, read as a whole, does not suggest the desirability of adding a volume percentage of 10% to 20%, thinning the resist to less than 100 nm, or increasing the concentration of the PAG. For the above reasons, the rejection under 35 U.S.C. §103(a) is improperly made.

The Examiner failed to establish a *prima facie* case of obviousness and failed to show there is teaching, suggestion, or motivation to combine the references. When applying 35 U.S.C. 103, the following tenets of patent law must be adhered to: (A) The claimed invention must be considered as a whole; (B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination; (C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and (D) Reasonable expectation of success is the standard with which obviousness is determined. Hodgsh v. Block Drug Co., Inc., 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986). "When determining the patentability of a claimed invention which combined two known elements, 'the question is whether there is something in the prior art as a whole suggest the desirability, and thus the obviousness, of making the combination.'" In re Beattie, 974 F.2d 1309, 1312 (Fed. Cir. 1992), 24 USPQ2d 1040; Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 730 F.2d 1452, 1462, 221 USPQ (BNA) 481, 488 (Fed. Cir. 1984). To defeat patentability based on obviousness, the suggestion to make the new product having the claimed characteristics must come from the prior art, not from the hindsight knowledge of the invention. Interconnect Planning Corp. v. Feil, 744 F.2d 1132, 1143, 227 USPQ (BNA) 543, 551 (Fed. Cir. 1985). To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the Examiner to show a motivation to combine the references that create the case of obviousness. In other words, the Examiner must show reasons that a skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the prior elements from the cited prior

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references for combination in the manner claimed. In re Rouffet, 149 F.3d 1350 (Fed. Cir. 1996), 47 USPQ 2d (BNA) 1453. "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or implicitly suggest the claimed invention or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." Ex parte Clapp, 227 USPQ 972, 973. (Bd.Pat.App.&Inter. 1985). The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Furthermore, although a prior art device "may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion or motivation in the reference to do so." In re Mills 916 F.2d at 682, 16 USPQ2d at 1432; In re Fritch, 972 F.2d 1260 (Fed. Cir. 1992), 23 USPQ2d 1780.

In the present invention, the cited references do not expressly or implicitly suggest any of the recited limitations. In addition, the Examiner failed to present a convincing line of reasoning as to why a combination of Honda, Livesay, Gonsalves and Fccly is an obvious application of absorptive resists.

Therefore, Applicants believe that independent claims 1, 9, and 17 and their respective dependent claims are distinguishable over the cited prior art references. Accordingly, Applicants respectfully request the rejections under 35 U.S.C. §103(a) be withdrawn.

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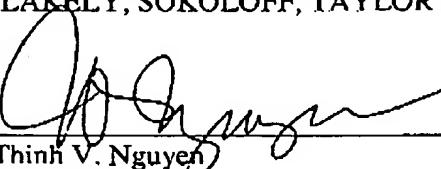
Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: December 8, 2006

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